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Thesis

A STUDY OF PEAK PERFORMANCES IN RELATION TO PRACTICE PERIODS

Submitted by

John Joseph Troy, Jr.

(B.S. in P.E. University of Notre Dame, 1947)

In partial fulfillment of requirements for the
degree of Master of Education.

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Thesis Approved:

First Reader:	Dr. John M. Harmon, Professor of Education
Second Reader:	Dr. Arthur G. Miller, Instructor of Education
Third Reader:	Dr. Leslie W. Irwin, Professor of Education

Acknowledgements

I wish to acknowledge the assistance of Dr. John M. Harmon, my adviser, for his numerous suggestions and helpful criticisms during the development of this research.

This thesis was made possible through the interest, encouragement, and the opportunity for work in this field which has been so generously given by Dr. Arthur G. Miller. To him I am extremely grateful.

The author wishes to acknowledge his deep indebtedness and sincere appreciation to his fellow colleagues of Boston University who took part in this experiment.

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CHAPTER I

INTRODUCTION AND PURPOSE

The author first became interested in time psychology during the course in Psychology of Physical Education by Dr. John M. Harmon. His interest was further stimulated by a study done by Dr. Arthur G. Miller. The topic of this research paper was suggested in the recommendations of advanced study by Dr. Miller in his doctoral dissertation.

The prevailing emphasis in our country today is placed upon athletes and athletic programs. A major factor in a successful season - one which produces a championship team or a star "titalist" - is the element of time. While this is going on many questions are directed in regard to practice sessions -- such as: How long should a practice last? How often should a team practice? What skills should be learned first?

The importance of a study of this kind cannot be minimized. As yet, there has been very little research done in this area especially in regard to athletics.

Many leaders in this field have expressed a grave concern over the amount of time that is consumed in practicing skills for their perfection. They have questioned the right

of athletics to be given prime importance and what amount of time was wasteful. We must realize that new methods must be devised so that an economical use of time will be realized. By finding and perfecting these methods the athletes will not have to spend many laborious hours in an effort to learn and retain motor skills. Teachers and coaches will have more free time; and expenses will be lowered thus relieving the heavy burden placed upon the taxpayer.

The purpose of this study is to determine the peak performance in a given time pattern for subjects using a motor skill.

CHAPTER II

REVIEW AND ANALYSIS OF THE LITERATURE

A directed review of the literature devoted to this phase of experimenting reveals the opinions of the following:

Snoddy [1] in his summary of an experimental investigation of a learned act states that there are two opposed or antagonistic growth elements. He states that primary growth appears early and is very stable; secondary growth appears later and is highly unstable. He further states, primary growth was shown to vary inversely as its base and directly as the amount of interpolated time. Secondary growth was shown to vary directly as its base and inversely as the interpolated time.

Kingsley [2] states for the more difficult and complex skills practice should be liberally distributed. In general, experimental evidence indicates the superiority of distributed practice over massed practice. He stresses primary and secondary growth in his writing. He defines them as, primary growth as a positive function of both repetition and the

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1/ Snoddy, George S., Evidence For Two Opposed Processes In Mental Health, Lancaster, Pennsylvania, 1935, The Science Press Printing Company, Chapter X page 99.

2/ Kingsley, Howard L., The Nature and Conditions of Learning, New York, 1946, Prentice-Hall Inc., pp 246-250.

interpolated time intervals. Secondary growth as the result alone of stimulation afforded by practice.

Griffith [3] states that there is a proper and favorable length for a practice period. He further reveals that continued practice of any skill beyond this limit without adequate rest leads to ineffective repetition. The greater the period of time which practice may be distributed, the greater will be the skill gained for each unit of time.

Woodworth [4] writes that most all experimenters have almost uniformly found an economy of learning time when that time is distributed over several sittings (spaced or distributed learnings) in comparison with the results obtained when the same total learning time is concentrated into one continuous sitting (massed learning).

Miller [5] Miller's study was the only study found that contained most of the factors covered in this experiment. His experiment was concerned with primary growth. He found that additive interpolated time patterns had a significant effect on motor learning.

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[3] Griffith, Coleman R., Psychology Applied to Teaching and Learning, New York, 1939, Farrar and Rinehart Inc., pp 197-199.

[4] Woodworth, Robert, Experimental Psychology, New York, 1938, Henry Holt and Co., Chapter IX, page 211.

[5] Miller, Arthur G., The Effect of Various Interpolated Time Patterns on Motor Learning, Doctors Dissertation, Boston University, 1948.

ANALYSIS

The review of literature revealed that in general the studies dealing with time psychology showed that for the more difficult and complex skills, practice should be liberally distributed. The experimental evidence indicated that the best results occurred when the practice sessions were distributed and not massed. Lack of research has limited the material available in this field.

CHAPTER III

PROCEDURE

The author had many sport-skills in mind before starting the actual research problem. He selected billiards because of the fact that they could be controlled and evaluated while still maintaining and developing interests. Practically all the other skills had one of these factors which would have been difficult or impossible to control.

A billiard table was available at 117 Newbury Street, Boston, Massachusetts, and this was the base of operations throughout the entire experiment. The shots 1/ used in the experiment were taken from those that Miller used in his experiment. The table was marked off with chalk, in this way the positions of the balls were always the same. The author was the only one who set the balls in position for the shots as a further measure of accuracy.

The writer visited a few classes and discussed the experiment. Seventeen (17) subjects volunteered who were interested in the subject material. The author told the subjects the purpose of the study and disclosed no other information which would have any effect on the outcome of the experiment.

1/ See page19.

In the selection of the subjects three requirements had to be met. (1) That the subject had played pool or billiards. (2) That during the length of the experiment he would not practice. (3) And lastly, that if a subject missed one practice he was disqualified and his data discarded. The experiment started with seventeen (17) subjects and lost only one.

Five set shots were utilized throughout the experiment. These five set shots consisted of ten tries, five on the right side of the table, and five on the left side of the table; for a total of ten tries per set shot and fifty shots per practice. It was found that the element of fatigue did not enter into the experiment when fifty shots were used. All the subjects were questioned and none were found to be fatigued at the close of the practice sessions.

The practice sessions were held on Monday and Wednesday for four weeks, resulting in a total of eight practice sessions. The experiment was started on April 26, 1948 and was completed on May 19, 1948. Fifty shots at each session, for eight sessions made a grand total of four hundred shots per pupil; or a total of six thousand four hundred (6400) shots for a final analysis.

A score sheet was prepared to record the score. A billiard resulted when the white ball hit the red ball;

and then hit the other white ball as illustrated in the Chart I page 19. A check was given for every billiard made, and zero was given for each one which was not made. A perfect score was ten per set shot. The total number of checks on the right side and the left side totaled gave the score for the practice sessions. A sample of the score sheet [1] will be found in the appendix. The subjects participated in pairs, and while one shot the other recorded the success or failure of the resulting tries.

The subjects possessed a knowledge of the fundamental skills and no help was offered in the way of corrective suggestions at any time during the experiment.

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[1] Appendix page 21.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Significance of Data

Significance of difference in means.-- When the difference (D) in the means (M) is 2.12 times the standard error (S.E.), the difference will be judged significant.

Significance of critical ratio[1].-- A critical ratio (C.R.) of 2.12 will be considered indicative of a significant difference since there are 98.3 chances out of a 100 that the mean for one practice session is greater than the mean for another practice session. This significance is at the 5 per cent level.

[1] Lindquist, E.F., A First Course in Statistics, The Cambridge Press, Houghton Mifflin Co., 1942, p 240.

The critical ratio for practice sessions one and two; and for practice sessions five and six were the only two which were statistically significant.

Table 1. Differences of Means of the Group for the Eight Practice Sessions.

Practice	No.	Mean	S.E.$_m$	Diff.$_m$	S.E.$_{diff.}$	C.R.
1	16	25.9	1.29	m2-m1	.91	3.00
*2	16	31.0	1.58	5.1	1.11	
2	16	31.0	1.58	m3-m2	1.11	1.08
3	16	32.3	1.17	1.3	.83	
3	16	32.3	1.17	m4-m3	.83	1.47
4	16	33.9	1.11	1.6	.78	
4	16	33.9	1.11	m5-m4	.78	.47
5	16	34.4	1.65	.5	1.17	
5	16	34.4	1.65	m6-m5	1.17	2.18
*6	16	36.3	1.47	1.9	1.04	
6	16	36.3	1.47	m7-m6	1.04	.06
7	16	36.4	1.65	.1	1.16	
7	16	36.4	1.65	m8-m7	1.16	1.08
8	16	35.7	1.41	-.7	1.00	

* Only two which are statistically significant.

The critical ratio of the difference between the first practice session and the second practice session is 3.00. There are 99.9 chances out of a 100 that the mean for practice session two is greater than for practice session one.

The critical ratio of the difference between the fifth practice session and the sixth practice session is 2.18. There are 98.5 chances out of a 100 that the mean for practice session six is greater than for practice session five.

Graph I on page 13 shows the mean scores of the group for the eight practice sessions for all set shots.

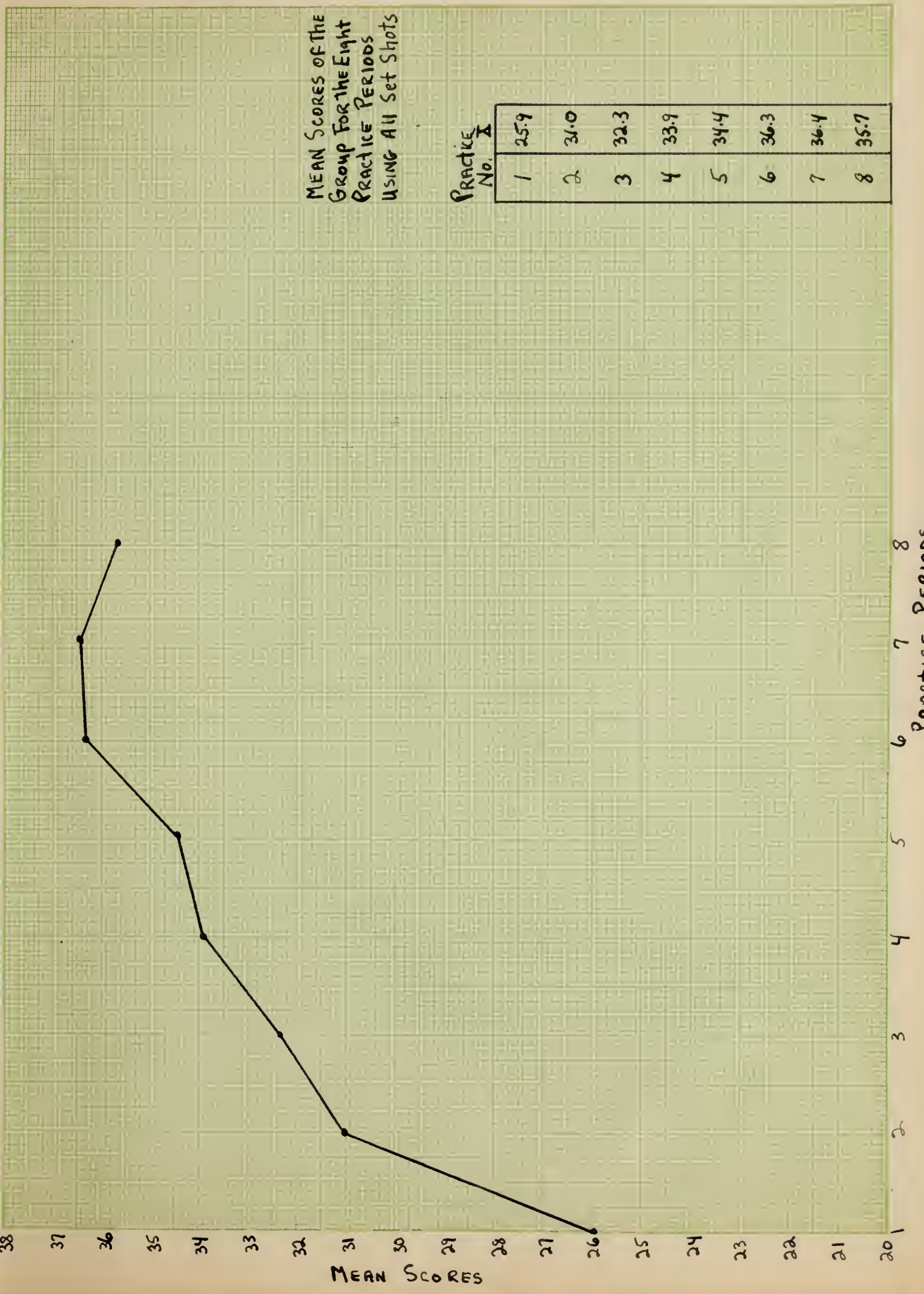
Graph II on page 14 shows on a time basis the mean scores of the group for the eight practice sessions of all set shots.

It may be noted that the greatest increase came between the first and the second practice session. The next largest increase came between the fifth and the sixth practice session.

From graph II it is evident that the greatest gains occurred between the Monday and Wednesday practices and not between the Wednesday and Monday practices.

It will be noted further that there was progression up to and including the seventh practice session. A possible explanation for the drop on the eighth day may be that it was the first day of the final examinations and all the participants had exams scheduled on that particular day.

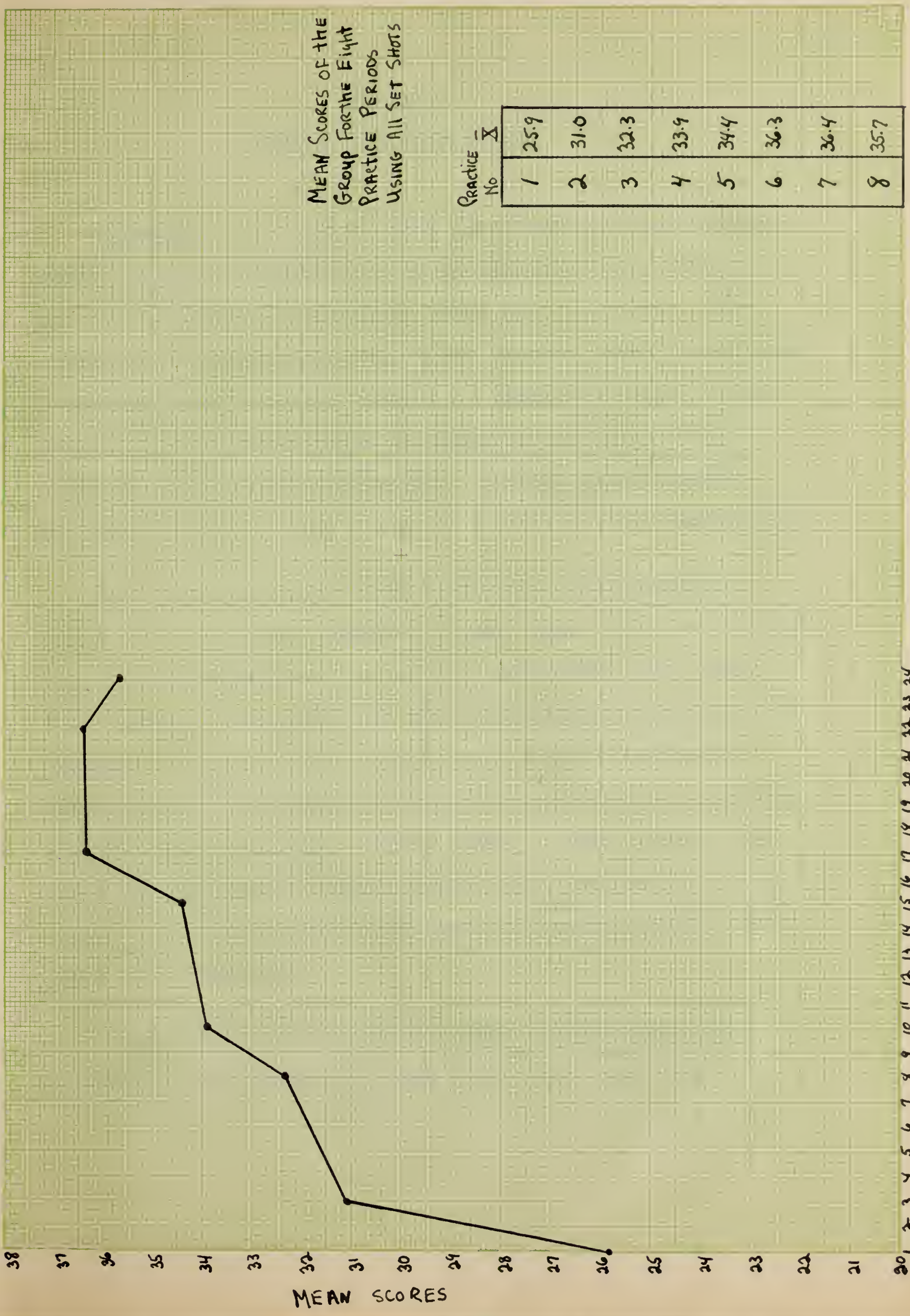
Graph I Mean Scores of the Group for the Eight Practice Periods of All Set Shots.



Mean Scores of the Group for the Eight Practice Periods Using All Set Shots

Practice No.	$\bar{X}$
1	25.9
2	31.0
3	32.3
4	33.9
5	34.4
6	36.3
7	36.4
8	35.7

Graph II Mean Scores of the Group for the Eight Practice Periods of All Set Shots on a Time Basis.



PRACTICE No	$\bar{X}$
1	25.9
2	31.0
3	32.3
4	33.9
5	34.4
6	36.3
7	36.4
8	35.7

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary.-- A study of peak performances in perfecting a motor skill in relation to an interpolated time pattern was conducted in an experiment based upon billiards. The decision to utilize this medium was reached after it had been determined that the motor skills of billiards could be controlled and evaluated while an interest in the activity could be promoted and maintained. Sixteen male students of Boston University were used as subjects in the experiment.

Five set shots were used throughout the experiment. These five set shots consisted of ten tries, five on the right side of the table, and five on the left side of the table; for a total of ten tries per set shot making fifty shots per practice. The practice sessions were held on Monday and Wednesday for four consecutive weeks, resulting in a total of eight practice sessions. Fifty shots at each session for eight sessions made a grand total of four hundred shots per pupil; or a total of six thousand four hundred (6400) shots for a final analysis.

Conditions and factors were kept standardized and maintained for the entire group during the experiment.

At the end of the experiment all information was analyzed and treated statistically.

From the resulting means of the score of each practice session it is evident that the group made progress through the seventh practice.

However, the greatest gain was shown between the first and the second practice session, while the second highest gain was between the fifth practice session and the sixth. The gains between the other practice sessions were not statistically significant.

Conclusions:--

1. It was shown that the five set shots used enabled the subjects to show progress as well as maintain interest.
2. The results of fifty tries per practice session on the secondary growth level showed that the element of fatigue did not affect the performance of the motor skill.
3. The greatest gain was evidenced between the first practice session and the second practice session. In all probability this gain was influenced by the fact that the subjects became acquainted with the specific skill during the initial practice session.

4. There was a statistical significance between the fifth and sixth practice session which showed the next greatest gain.
5. Greater gains were made between Monday and Wednesday than between Wednesday and Monday. This may indicate that practices should be conducted more frequently than twice a week for maximum performance.
6. The seventh practice session was the one in which the peak performance was reached by the group, but was not significantly greater than the sixth practice session.
7. In comparing the results with Miller's Group I, Set Shot 5, the following was noted:
   (Miller) His group performed three times per week for three weeks and there was a slight decrease in performance on Mondays. (primary)
   (Troy) His group performed two times per week for four weeks and they showed a slight increase on Mondays. (secondary)

In conducting further research it is suggested that similar experiments be set up using different time patterns so that comparisons might be made to determine the time pattern which would produce the best results.

APPENDIX

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Chart I Set Shots 1,2,3,4,5 on Right and Left Sides of Table Respectively.

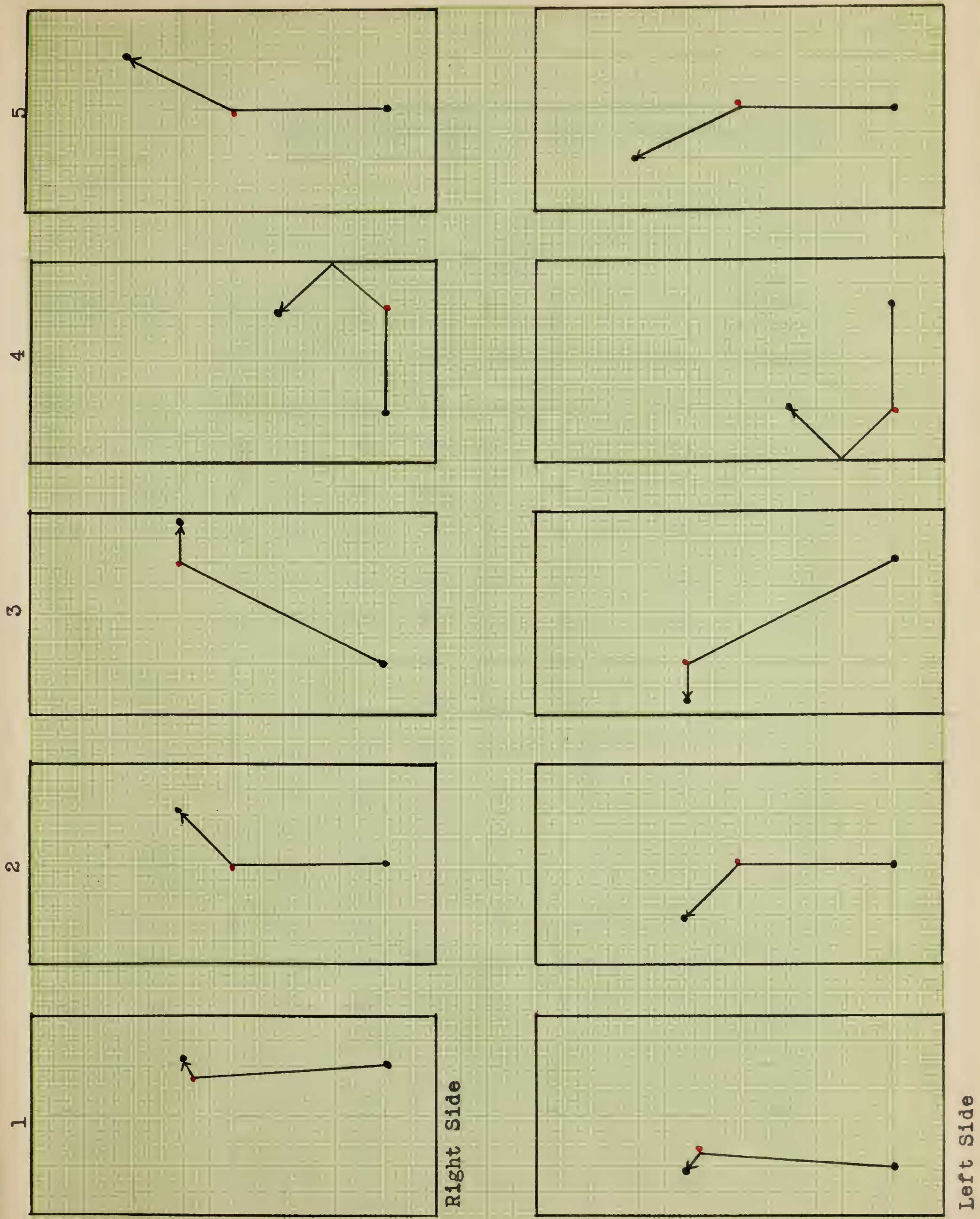
5
4
3
2
1
Right Side
Left Side

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Table 2. Raw Scores, Means, Ranges and Standard Deviation for the Group of Eight Practice Sessions Using All Set Shots.

		Practice Periods								
Names	No.	1	2	3	4	5	6	7	8	Sub Totals
A.G.	1	33	37	37	33	37	40	38	34	289
A.K.	2	33	36	38	39	42	44	41	40	313
R.K.	3	32	21	28	38	44	42	32	30	267
L.C.	4	30	42	36	38	45	52	48	44	325
R.S.	5	30	33	35	30	35	38	35	37	273
W.W.	6	29	41	38	33	35	34	37	31	278
O.B.	7	28	23	25	30	28	40	36	38	248
L.T.	8	26	33	37	39	39	42	37	42	295
R.B.	9	26	31	32	32	36	38	36	41	272
L.R.	10	24	33	27	32	25	27	39	37	244
F.C.	11	24	28	36	36	29	33	37	35	258
N.B.	12	23	25	35	41	39	39	42	40	284
J.H.	13	21	30	31	35	35	34	40	39	265
J.L.	14	20	22	26	28	25	27	30	30	208
J.T.	15	18	33	38	34	32	36	38	30	249
A.S.	16	17	28	28	25	25	25	17	23	188
Totals		414	496	517	543	551	581	583	571	4256
Means		25.9	31.0	32.3	33.9	34.4	36.3	36.4	35.7	265.9
Ranges		17 33	21 42	25 38	25 41	25 45	25 44	17 48	23 44	178 335
S.D.		4.98	6.11	4.54	4.29	6.40	5.70	6.38	5.46	43.86

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BILLIARD SCORES

NAME: ____________________ DATE: ________ TIME: ________

GROUP: TEST:

Shot No.	Right Side Scores					Totals	Left Side Scores					Totals
	Total Right Side Score						Total Left Side Score					

✓ Successful Shot

0 Unsuccessful Shot

Total Left Side Score	
Total Right Side Score	
Total Score	

BILLIARD SCORES

NAME: ____________________ DATE: ________ TIME: ________

GROUP: TEST:

Shot No.	Right Side Scores					Totals	Left Side Scores					Totals
	Total Right Side Score						Total Left Side Score					

✓ Successful Shot

0 Unsuccessful Shot

Total Left Side Score	
Total Right Side Score	
Total Score	

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